SATELLITES: SHAPING THE FUTURE

Remarks by
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Thank you all very much.

Woody Allen once said, *"90% of life is just showing up"* – just looking around this room, I think that the size and enthusiasm of this crowd says something very powerful in and of itself. The fact that so many of you have chosen to show up here is a real testament to the future of this industry and the recognition that technologies currently in development to support your work will hugely impact the makeup of the world we leave our children and grandchildren.

These technologies will help shape the future of science. They will help shape the future of our economy.

What's more, these developing technologies will help shape our future quality of life – and perhaps even the future of life itself, on a planet that's climate is changing.

With this in mind, when I think about what the satellite industry means for the future, I can't help think of my grandchildren and the world in which they'll raise their own children. They are growing up in times when data from satellites are helping inform and teach us about every facet of our planet: from our oceans and rivers to our soil and Earth's landmass to its atmosphere. As a result, I fully believe that someday their children might very well breathe cleaner air, swim in cleaner waters and live on a planet that finally has found a way to reverse the impact of climate change.

What's more, they will, hopefully, be working in better jobs, because of NASA's work today in partnership with many of the companies and organizations represented at this conference.

They might be living in a better world because some of the people whose lives were saved today thanks to satellite technologies that were put to use during a natural disaster – or beforehand – went on to cure diseases, invent new things and raise great families.

As we look toward this world we leave our children and grandchildren, they might also very well be enjoying a better quality of life because the innovators of tomorrow are using satellite technologies for things of which we are yet to even dream.

When our parents and grandparents raised us, it never even crossed most of their minds that some day we'd be driving to meet up with our families for Easter or Passover guided by GPS, all while listening to tunes in our cars that are beamed down to us on satellite radio. They couldn't have imagined that we'd make our travel plans, mindful of satellite-driven weather forecasts.

How could they have foreseen our current times when our loved ones are kept safe by servicemen and women around the world and law enforcement officials here at home who are making use of satellite imagery to monitor people who would do us harm? Just imagine what this next generation will dream devise thanks to the incredible progress of your industry and the technologies that support it!

I'd be remiss – since we're talking about the future – if I didn't also mention that a young person today aged 15 or younger has lived every single day of her or his life in times when astronauts from different countries are living and working together in space aboard the International Space Station.

It's one of the reasons I like to refer to this generation as the "space generation." By the same note, it's very possible that the next generation may very well be the "Mars generation" – the Mars generation, I'll get back to this in a moment.

First, I thought I'd give you just a little sampling of some of the exciting work we have underway at NASA right now as it relates to satellites – including work that we're doing with some of your companies and organizations.

As technology advances, one area where we see a lot of potential is with hosted payloads, which, as many of you know, is when we attach a small experiment or research module to a satellite. Even though the module and its host share the same power supply and transponders, the module operates independently.

One of the more high profile examples is our Tropospheric Emissions: Monitoring of Pollution mission or *TEMPO*. When completed in 2017, the instrument will be

attached to a commercial satellite as a hosted payload that will be used as the first space-based instrument to continuously monitor major air pollution across North America from geostationary orbit throughout the daytime.

Because we'll be able to hitchhike or share a ride with a commercial satellite, *TEMPO* will cost in the ballpark of only $90 million – far less than the hundreds of millions that it otherwise would if we had to launch it as a free flyer mission with its own dedicated launch vehicle.

We have a number of Earth Science and Space Technology missions planned that are considering the use of hosted payloads. The breadth and range of satellite buses, frequency of launch and orbits that you all offer greatly enhances the options available to NASA to design future missions in a cost-effective and efficient manner. In so doing, a collaborative partnership can be forged between us, leveraging what the commercial industry can best provide with what NASA does best.

As we look at a number of avenues of potential partnership, we're putting a special priority on small satellites, especially CubeSats.

Like so many of you, we recognize that when we're able to make our launches more affordable and when we're able to schedule our launches more rapidly, the results will be transformative and will potentially attract more young scientists and engineers into our field.

We all have a stake in seeing a broad range of engineers and scientists – with diverse backgrounds and fresh ideas – gain early and more frequent opportunities to participate directly in space missions, beginning when they are students and throughout their careers.

I'm pleased to be able to tell you that this is going to be a big year for NASA Small Spacecraft Technology.

This week, the *Nodes* mission is scheduled to be deployed from the International Space Station. Using two CubeSats, it will make coordinated measurements of the radiation environment in space. This can be an important precursor for future missions that might involve large numbers of network satellites.

This, as the expression goes, is only the beginning. We'll be working with industry partners throughout the year on demonstration missions in areas like high-data-rate laser communication, docking multiple CubeSats in space and speeding up data

transmission rates by using the back of a deployed solar array as a reflector for a radio antenna.

We're also looking forward to future missions that use CubeSat buses for demonstrations in areas like propulsion, control and communications.

Those of you who are interested in participating in and applying for NASA Tipping Points Technology contracts or Small Business Innovation Research projects may be interested to know that both these initiatives are providing payloads for some of our upcoming missions.

Now, I've talked a lot about technology because at NASA we recognize that technology drives both exploration and economic growth. It's therefore a big priority for us.

Another priority is studying, understanding – and perhaps even saving – the most important planet that I know of ... Earth.

We have a bunch of satellite-driven Earth science missions already in orbit and others scheduled to launch. I gave the example of *TEMPO* earlier and I thought I'd focus in on one more that we're particularly excited about.

It is called the Cyclone Global Navigation Satellite System – or *CYGNSS* and it's scheduled in launch in October. Using innovative small satellite technology, *CYGNSS* will measure surface wind speeds in and near the inner core of hurricanes. This, as you may know, is a key measure of hurricane intensity.

This ability to monitor and predict rapid changes in hurricane intensity is critically important to hurricane forecasters. It is also an important tool for those emergency managers responsible for the protection of the health and welfare of coastal communities.

The way it works is – I think the scientific term for it is "very cool." It's a constellation of eight small satellites. Each of these small satellites, all eight of them, are able to capture wind measurements and, in fact, to capture these measurements rapidly.

Taken together, as a constellation, the measurements we receive from these small satellites will provide complete coverage of the surface wind field over the key hurricane-forming regions of an entire ocean.

Now if this sounds impressive – and I hope it does, because quite frankly I'm impressed by it – I'm able to tell you that there is even more exciting news where this comes from. You see, *CYGNSS* is actually the first of a series of low-cost, space-based science investigations that are part of an initiative we call "Earth Venture." *TEMPO* will be another.

These Earth Venture missions are science-driven, competitively selected, and low cost. They are designed to enhance our capability to better understand the current state of the Earth system and to enable continual improvement in the prediction of future changes.

With this in mind, I want to leave you today with touching on something that I opened with – and that's the "Mars generation."

On May 30, 1971 – nearly 35 years ago, NASA successfully launched the Mariner 9 mission. History buffs may recall that Mariner 9 was the first artificial satellite of Mars.

So for three and a half decades, satellite technology and interest in exploring Mars have been intertwined. For the foreseeable future both these areas will be among the great sources of progress and priority both for us at NASA and for our partners across domestic industry sectors and across the world.

Right now, we're on a Journey to Mars and we're making progress as we speak. If you go to NASA.gov you've find our plan and we hope you'll agree that it is clear, affordable, sustainable and attainable.

What I can tell you is that there is a new consensus emerging in the scientific and policy communities around not only our strategy for getting to Mars, but also our timetable for sending astronauts there in the 2030s – and also, quite frankly for Mars as a destination in the first place. That hasn't always been the case.

Instead of asking is Mars the right destination?" or "Why aren't you doing things my way?" more are asking, "How can we be a part of this?" and "What are some areas where we can work together?"

Whether it's working with commercial partners to return space cargo launches to American soil, which we've done – or working with industry to return human launches to American soil, which we're doing – or it's working with you and your colleagues to advance satellite technologies, we believe very strongly that the sort of

future for our children and grandchildren about which I spoke earlier is something we must bring about together.

Many of you have heard me say before, at NASA, we make the impossible possible and we turn science fiction into science fact. We need you on our team with all the energy and enthusiasm you can muster. The future generations who will stand on our shoulders deserve nothing less.

Thank you all very much.